Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2140107 **Date: 03/06/2017**

Subject Name: Computational fluid dynamics I

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1		**Short Questions**	**14**
	1	What is CFD?	
	2	What is the need of boundary conditions?	
	3	List areas of CFD applications.	
	4	Name the basic working principles for fluid flow systems	
	5	Define an implicit approach.	
	6	Name different fluid flow models.	
	7	Why grid generation is required?	
	8	What is an initial condition given to a problem?	
	9	State the Newton's second law of motion.	
	10	Why generic form for CFD is important?	
	11	What is structured grid?	
	12	Define substantial derivative	
	13	Define an explicit approach.	
	14	Differentiate between accuracy and precision.	
Q.2	**(a)**	Derive the expression of substantial derivative.	**03**
	(b)	Derive continuity equation in Cartesian	**04**
	(c)	Derive the generic form for CFD for the complete flow system.	**07**
		OR	
	(c)	Solve FVM problem for 1-D heat diffusion.	**07**
Q.3	**(a)**	Draw a small element representing all the forces acting on it to derive a momentum equation in X direction.	**03**
	(b)	Explain in detail the different types of fluid flow.	**04**
	(c)	What is descretization? Why it is required? List the basic descretization techniques.	**07**
		OR	
Q.3	**(a)**	Differentiate FDM, FEM and FVM.	**03**
	(b)	Write a short note on error and stability. And define the stable equation.	**04**
	(c)	Write a short note on Maccormark Technique	**07**
Q.4	**(a)**	Explain the steps for CFD preprocessing.	**03**
	(b)	Explain the steps for CFD post processing.	**04**
	(c)	Derive 1^{st} order derivatives following forward difference, backward difference and central difference schemes.	**07**
		OR	
Q.4	**(a)**	Explain the need to study mathematical behavior of governing equations for a fluid flow system.	**03**
	(b)	Explain the Eigen value method in short.	**04**
	(c)	Derive the energy equation for 3-Dimensional, viscous flow.	**07**

Q.5	**(a)**	Write a short note on unstructured grid.	**03**
	(b)	Write a short note on structured grid.	**04**
	(c)	Write a short note on implicit approach and explicit approach.	**07**

OR

Q.5	**(a)**	Explain the concept of transformation of grid.	**03**
	(b)	Derive 2^{nd} order derivative terms of Laplace equation in difference terms	**04**
	(c)	Write a short note on Lax-Wendroff technique	**07**

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